1. McTaggart’s paradox; the A/B distinction and its connection to semantics

McTaggart (1908) suggested that in conceiving of time as a series we are faced with a choice between at least two competing pictures. The two pictures which are the main legacy of his work are what he called the “A-series” and the “B-series”:

A-series: “the series of positions running from the far past through the near past to the present, and then from the present to the near future and the far future.”

B-series: “the series of positions running from earlier to later.” (ibid.)

McTaggart claims that change is a necessary feature of time, and that since facts about the B-series never change (if something is ever earlier or later than something else, it always is), then the A-series, in which facts are constantly changing from future to present to past, is necessary for time. But, he argues, the A-series entails a contradiction that can’t be removed without starting a “vicious circle”:

"Past, present, and future are incompatible determinations. Every event must be one or the other, but no event can be more than one. This is essential to the meaning of the terms ... The characteristics, therefore, are incompatible. But every event has them all. If M is past, it has been present and future. If it is future, it will be present and past. If it is present, it has been future and will be past. Thus all the three incompatible terms are predicable of each event which is obviously inconsistent with their being incompatible ... It may seem that this can easily be explained. Indeed it has been impossible to state the difficulty without almost giving the explanation, since our language has verb-forms for the past, present, and future, but no form that is common to all three. It is never true, the answer will run, that M is present, past and future. It is present, will be past, and has been future. Or it is past, and has been future and present, or again is future and will be present and past. The characteristics are only incompatible when they are simultaneous, and there is no contradiction to this in the fact that each term has all of them successively. But this explanation involves a vicious circle. For it assumes the existence of time in order to account for the way in which moments are past, present and future. Time then must be pre-supposed to account for the A series. But we have already seen that the A series has to be assumed in order to account for time. Accordingly the A series has to be pre-supposed in order to account for the A series. And this is clearly a vicious circle.” (ibid.)

He goes on to argue that since the A-series is necessary to account for time and the A-series entails an inescapable contradiction, then time must not exist. Few philosophers since McTaggart have taken up this exact position, but two opposing camps have evolved among philosophers of time based his distinction between the A-series and the B-series. The first camp, the “A-theorists,” typically claim that A-properties are fundamental: for them, time is a series in which every moment is either past, present, or future, and if relations of earlier and later hold between them, it is in virtue of A-facts that they do. For those in the second camp, the “B-theorists,” B-properties are fundamental, i.e., time is a series in which every moment is either earlier or later than every other moment, and if moments ever appear to be past, present, or future, it is in virtue of B-facts that they do.

Typical B-theories hold that all moments of time are equally real. But two of the three main A-theories deny reality to at least one category of moments:

Eternalism: the past, the present, and the future are real.
Growing Universe Theory: only the past and the present are real.
Presentism: only the present is real.

The choice of one metaphysical picture of time over the others has wide-ranging consequences, not the least of which appear in questions about the semantics of temporal expressions. For example, if the B-theorist is correct, then tensed utterances will be true or false solely in virtue of B-facts (where is* is tenseless):
“Fred was hungry.” uttered at time $t$ is true iff there is a time $t'$ before $t$ such that Fred is* hungry at $t'$.

But if the A-theorist is correct, only tensed facts do:

“Fred was hungry.” is true iff Fred was hungry.

And if the presentist is correct, then only present facts do:

“Fred was hungry” is true iff right now the world is such that . . .

A-theorists have argued from certain consequences of B-theory semantics against B-theory metaphysics. Consider sentences (1) and (2), both uttered at 5:00:

1. The meeting starts now.
2. The meeting starts at 5:00.

On a B-theory semantics, they have the same truth conditions:

“The meeting starts now” uttered at 5:00 is true iff the meeting starts at 5:00.

“The meeting starts at 5:00” uttered at 5:00 is true iff the meeting starts at 5:00.

But in many contexts, they seem to express different things. For example, whether I believe (1) or (2) at five o’clock will affect my actions: if I believe (2) and don’t realize it’s five o’clock, I won’t go to the meeting; but if I believe (1), I will go to the meeting regardless of what time I think it is. Since the B-theory semantics is unable to distinguish this apparent difference in content, A-theorists argue, it is inadequate. Ludlow (1999), a presentist, argues that both an A-theory semantics and an A-theory metaphysics are necessary to explain differences like this.¹

## 2. Natural language as the language of thought and Ludlow’s “broadly Kantian” approach to metaphysics

In approaching the questions of the relative priority of the A- and B-series and the meaning of temporal expressions like (1) and (2) above, Ludlow (1999) assumes what he considers to be a “broadly Kantian” (p 4) approach in which the nature of reality cannot be discovered without some investigation into the nature of human thought.

“...I assume that we have partial knowledge of the nature of reality and partial knowledge of the theory of meaning, and that our task is to solve a kind of complex equation involving information from semantics on the one side and metaphysics on the other. What we know about the nature of reality will help shape our semantic theories, but it is also the case that semantic theory will help to shed light on the nature of reality.” (p 5)

He then suggests that human thought is fundamentally linguistic in nature. For Ludlow, answering metaphysical questions about time will now involve investigating the semantics of time that applies to the “language of thought” (§1.3). But what exactly is the language of thought, and how is it related to the languages we speak?

¹It may be that the difference between (1) and (2) is not semantic; i.e., their truth conditions are identical, but something about the nature of belief makes believing the content (1) different from believing the content (2). In this case, a B-theory semantics could be sufficient, provided the difference is explained elsewhere, e.g., in a theory of belief.
Following Chomsky (1986), Ludlow makes the following distinction: I-language (or ‘internal’ language) is “an internal computational system that is part of our biological endowment” (p 19) which we “have co-opted for communication and for other purposes” (p 17), and an E-language (or ‘external’ language) is one of the social objects we refer to when we talk about English, Spanish, Mandarin, etc. Ludlow argues that since proper boundaries between distinct E-languages and between distinct E-idiolects are impossible to establish (he claims that it’s impossible both to determine where, e.g., Spanish begins and Italian ends and to determine where someone’s idiolect ends and where meaningless noises (e.g., coughs and sneezes) begin), E-languages cannot be individuated as “natural objects,” and thus all talk of language must be replaced with talk of the internal computational system that explains our linguistic competence (§1.1).

Ludlow then suggests that although the standard view is that language is primarily for communication and thus that the propositional content of a given utterance is constant through time and space (he notes that language wouldn’t be very useful for communication if this wasn’t the case), given that I-language is a biological endowment like any other and thus that any claims about its purpose are subject to the same controversy that surrounds the “doctrine” of teleological explanation in evolutionary theory, even if we discover all the details about some function of language we still can’t know for sure what its other or original purposes are (§1.2). This lays the groundwork for the possibility that one of the functions, maybe the primary function, of language is to serve as the mechanism of thought. Ludlow seems to think this is the case, but admits that he hasn’t provided “knock-down evidence” (p 26), and claims that whether it is the case or not, the rest of his argument will remain essentially unaffected.

Ludlow’s approach thus involves the simultaneous investigation of issues in the metaphysics of time and issues in the semantics of temporal expressions.

3. Absolute truth-conditional semantics

Faced with what he perceives as a choice between three distinct approaches to semantics (structural, model-theoretic, and truth-conditional), Ludlow concludes that only an absolute truth-conditional approach can fulfill the purpose of semantic theory (to characterize a speaker’s semantic knowledge, including “the speaker’s knowledge about the connection between language and the world” (p 31)). According to Ludlow, structural semantics, which maps natural language expressions onto expressions of some representational language which does things like eliminate ambiguity and provide entailment relations, fails because it lacks connection to the world, and model-theoretic semantics, which maps natural language expressions onto model-theoretic entities like sets of possible worlds or individuals, fails for the same reason (pp. 29-31). Absolute truth-conditional semantics, in which the meanings of natural language expressions are given in the form of truth conditions, on the other hand, provides genuine language-world connections via the metalanguage statements in which the truth conditions are given.

An absolute truth-conditional semantic theory takes the form of a set of axioms by which biconditional T-theorems (statements of truth-conditions) can be recursively derived for any sentence in the object language. The semantic axioms presuppose the existence of an appropriate set of syntactic rules by which the hierarchical structure of each sentence can be determined:

2Ludlow also introduces two distinctions which he uses to further delineate the purpose of such a theory in his scheme: first, the distinction between interpretive and non-interpretive truth-conditional semantic theories, and second, between modest and robust semantic theories. The first distinction is introduced merely by example, but the basic idea seems to be that interpretive semantic theories actually give the contents of object language expressions whereas noninterpretive theories just happen to give the correct truth conditions:

- T-theorem derived from an interpretive semantic theory: “Snow is white” is true iff snow is white.
- T-theorem derived from a noninterpretive semantic theory: “Snow is white” is true iff grass is green.

Ludlow makes it clear that his interest is in providing an interpretive semantics for natural language, and goes on to situate his work with respect to “modest” and “robust” semantic theories. A robust semantic theory must “explain the abilities that underlie our semantic competence” (p 38). While a theory with T-theorems like “Snow is white” is true iff snow is white can tell us that “snow” refers to snow, it does not tell us about the knowledge we use to identify snow, and it is because of this that it is a modest, not a robust, semantic theory. Ludlow asserts that modest and robust semantic theories “are theories of the same phenomenon at different levels of abstraction and idealization” (p 39), and plans to develop the modest part of a semantic theory which can later be combined with the robust parts of the theory as developed by researchers in areas such as lexical semantics, natural language processing, and psychology.
**Syntax**

S → S1 and S2
S → S1 or S2
S → it is not the case that S1
S → NP VP
NP → Dick, Sally
VP → leaps, walks

**Semantics**

Val(x, “Dick”)³ iff x = Dick
Val(x, “Sally”) iff x = Sally
Val(x, “leaps”) iff x leaps
Val(x, “walks”) iff x walks

Val(True, [S NP VP]) iff, for some x, Val(x, NP) and Val(x, VP)
Val(x, [α β]) iff Val(x, β), where α ranges over categories and β ranges over categories and lexical items
Val(True, [S S1 and S2]) iff Val(True, S1) and Val(True, S2)
Val(True, [S S1 or S2]) iff Val(True, S1) or Val(True, S2)
Val(True, [S it is not the case that S1]) iff it is not the case that Val(True, S1)

**Example derivation⁴**

“Dick walks and it is not the case that Sally leaps.”

![Syntax Tree](image)

³“Val(x, y)” means “x is the semantic value of y.”
⁴To do a derivation we will also need to assume two “production rules” (p 35):

(1)

```
...α...
α iff β
...β...
```

(2)

```
Φ iff for some x, x = α and ...x...
Φ iff ...α...
```

4
1. “Dick walks and it is not the case that Sally leaps” is true iff Val(True, [s1 [NP Dick] [VP walks]]) and Val(True, [s2 it is not the case that [s2 [NP Sally] [VP leaps]])

2. . . . iff for some x, Val(x, [NP Dick]) and Val(x, [VP walks]) and it is not the case that Val(True, [s2 [NP Sally] [VP leaps]])

3. . . . iff for some x, Val(x, “Dick”) and Val(x, “walks”) and it is not the case that for some y, Val(y, [NP Sally]) and Val(y, [VP leaps])

4. . . . iff for some x, x = Dick and x walks and it is not the case that for some y, Val(y, “Sally”) and Val(y, “leaps”)

5. . . . iff Dick walks and it is not the case that for some y, y = Sally and y leaps

6. . . . iff Dick walks and it is not the case that Sally leaps

4. Metaphysical commitments of semantic theories

Given that Ludlow’s goal is to solve the “complex equation involving information from semantics on the one side and metaphysics on the other,” what sort of influence will the semantic side of the equation, once we have an appropriate semantic theory, have on the metaphysical side? Ludlow’s view is that, “to be is to be a semantic value” (p 66). In other words, if something appears in the theory as the semantic value of an expression, then it must exist. Since each axiom of an absolute truth-conditional semantics has an implicit universal quantification, e.g.

Val(x, “snow”) iff x = snow

∀x[Val(x, “snow”) iff x = snow]

and since this quantification “is not vacuous” (p 66), such an axiom commits us to the existence of snow.

In some cases we face a choice between alternative axioms that seem to have equivalent theoretical functions but very different metaphysical commitments. For example, consider the following axioms for the word “dog”:

Val(x, “dog”) iff x is a dog

Val(x, “dog”) iff x = the property of being a dog

The first commits us to the existence of dogs, whereas the second commits us to the existence of the property of being a dog. Ludlow argues against the existence of properties, providing some counterexamples to Wright’s (1983) and Chierchia’s (1984) observations that properties seem to be regularly pronominalized and quantified over.

There are also cases in which semantic axioms seem to commit us to the existence of objects we know to be nonexistent:

Val(x, “Pegasus”) iff x = Pegasus

To avoid such undesirable metaphysical commitments, Ludlow proposes that words like “Pegasus” are actually definite descriptions in disguise, so that the evaluation of a term like “Pegasus” involves not a single axiom like the one above, but the various axioms for the various words in the definite description (in this case, things like “white,” “winged,” etc.), which have no worrisome metaphysical commitments.

Of course, the way a semantic theory provides meanings for temporal expressions has metaphysical consequences, too. For example, if we take verb phrases to denote events, then we commit ourselves to the existence of events. Davidson (1967) argued for the existence of events based on the observation that if we ascribe the following logical form to an action sentence like “John ate the chips gracefully,” we can easily explain the inference to “John ate the chips”:

5I have no idea what this means.
∃e[ate(John, the chips, e) & graceful (e)]

Ludlow leaves open the possibility that events exist\(^6\), but the more important questions for him as a presentist are whether the semantic axioms involve commitment to time as an A-series or a B-series and whether they involve reference to past and future events.

### 5. Why presentism?\(^7\)

Ludlow appears in this work to be compelled primarily by phenomenological considerations to adopt presentism (§9.2). Following Merleau-Ponty (1962), he claims that since we do not experience things as past or future, but only as present, that presentism is much more compatible with our experience than a metaphysical picture in which past or future events are real, or in which A-properties like ’present’ themselves don’t exist or are derivative. The following passage from Merleau-Ponty (ibid.), which Ludlow quotes on p. 143, foreshadows his account (§7.1) of how past and future tense sentences are evaluated:

> “Time is therefore not an actual process, not an actual succession that I am content to record. It arises from my relation to things. Within things themselves, the future and the past are in a kind of eternal state of pre-existence and survival; the water which will flow by tomorrow is at this moment at its source, what has just past is now a little further downstream in the valley. What is past or future for me is present in the world.” (Merleau-Ponty, 1962, p. 412)

### 6. A-theory and B-theory semantics

Ludlow goes on to give his account of the distinction between the tenseless approach to semantics, in which truth conditions are given tenselessly and with reference to past and future times, from the tensed approach, in which truth conditions are given in tensed metalanguage without reference to past and future times. Given Ludlow’s view that “to be is to be a semantic value,” the first approach, which arguably characterizes much of contemporary work in formal semantics (e.g., Partee, 1984), appears to entail a B-series metaphysics of time, and the second, which is “virtually ignored” in semantics (p 145), appears to entail an A-series metaphysics. According to Ludlow, a typical B-theory semantics includes axioms for tensed utterances in which the time of the utterance appears both as an argument for the evaluation function and in the metalanguage truth conditions:

\[
\text{Val}(\text{True, “Fred is hungry”, } t) \iff \text{Fred is* hungry at } t
\]

Axioms for past and future tense utterances again feature the time of utterance as an argument in the evaluation function but also feature an existential quantification over past or future times in the metalanguage truth conditions:

\[
\text{Val}(\text{True, “Fred was hungry”, } t) \iff \text{for some time } t' \text{ earlier than } t, \text{Fred is* hungry at } t'
\]

\[
\text{Val}(\text{True, “Fred will be hungry”, } t) \iff \text{for some time } t' \text{ later than } t, \text{Fred is* hungry at } t'
\]

Ludlow argues that since “metalanguage quantification over times” is ubiquitous in accounts like these, and since “it is supposed that the values assigned to [the variables for times that are quantified over] stand in
certain temporal relations to each other . . . it seems that this semantic theory is committed not only to the existence of times but also to their standing in certain temporal relations to each other” (p 85).

On the other hand, a typical A-theory semantics, according to Ludlow, includes axioms in which the tense of the object language sentence is transferred directly into the metalanguage:

\[
\text{Val(True, “Fred is hungry”)} \iff \text{Fred is hungry}
\]
\[
\text{Val(True, “Fred was hungry”)} \iff \text{Fred was hungry}
\]
\[
\text{Val(True, “Fred will be hungry”)} \iff \text{Fred will be hungry}
\]

The pair of apparently distinct sentences which was problematic for the B-style semantics receives appropriately distinct truth conditions on this theory:

“The meeting starts at 5:00” is true iff the meeting starts at 5:00

“The meeting starts now” is true iff the meeting starts now

According to Ludlow, the difference between the metalanguage temporal expressions at 5:00 and now is sufficient to completely account for the difference in, e.g., the effects that believing the content of each of these two utterances has on our actions.

7. The B-theory account of complex tenses

To account for complex tenses like past perfect and future perfect, the B-theory approach has incorporated (following Reichenbach 1947) a context-supplied reference time, R (using Reichenbach’s notation, S = speech time, E = event time):

Present: Val(True, “Fred is hungry”, S, R, E) iff S=R and E overlaps with S/R and Fred is hungry at E

Simple past: Val(True, “Fred was hungry”, S, R, E) iff R=E and R/E is before S and Fred is hungry at R/E

Present perfect: Val(True, “Fred has been hungry”, S, R, E) iff S=R and E is before S/R and Fred is hungry at E

Future: Val(True, “Fred will be hungry”, S, R, E) iff R=E and R/E is after S and Fred is hungry at R/E

Past perfect: Val(True, “Fred had been hungry”, S, R, E) iff E is before R and R is before S and Fred is hungry at E

Future perfect: Val(True, “Fred will have been hungry”, S, R, E) iff E is after R and R is after S and Fred is hungry at E

8This raises some questions about the usefulness of a “context-sensitive” semantic theory (Lepore & Ludwig, 2003):

“(1) ‘I am tired’ in L means that I am tired.

(2) ‘I am tired’ in L is true iff I am tired.

But (1) and (2) express nothing unless relativized to a context of utterance, and what they express in a context depends on who utters them and the time of utterance. This creates two related difficulties. First, theorists employing identical adequacy criteria will arrive at nonequivalent theories, since they will express different propositions by the sentences they use. Second, no one will give the correct account of the meanings or truth conditions of sentences with context-sensitive elements. Were we each to assert (1), one of us would assert that ‘I am tired’ means that Ludwig is tired at such and such a time, while the other would assert that it means that Lepore is tired at such and such a time. But ‘I am tired’ means neither.

A semantics for a language should be couched in a context-insensitive metalanguage. We want theories that any inquirer can reach by meeting generally agreed upon theoretical constraints and that can be used to express the same thing in every context. This requires metalanguage expressions, including semantic predicates, to be untensed.”
Given that presentism precludes reference to past and future events, accounting for complex tenses is a special challenge for Ludlow. In fact, giving the correct truth conditions for even some simply tensed sentences seems to require reference to non-present events. Consider an example from Partee (1984):

“I didn’t turn off the stove.”

On a typical approach where both the tense and the negation are taken as operators that can have scope over one another, the sentence has two interpretations, depending on which one takes wider scope. If the past tense takes scope over the negation, the sentence means something like the following:

There is a time in the past at which I did not turn off the stove.

This sentence is true in almost all circumstances—no one spends their entire life turning off a stove—but we want our semantic theory to explain why “I didn’t turn off the stove” seems to be meaningful (i.e., true) under only certain circumstances, e.g., after I’ve left my home and am on my way to school.

If the negation takes scope over the past tense, the sentence means instead something like the following:

It is not the case that at some time in the past I turned off the stove.

But most if not all people who can use this sentence informatively (like I might on my way to school) have turned off the stove at least once in their lives. Once again, the theory seems to be giving this sentence too general a meaning.

The solution proposed by Partee (1984) is to treat tense as temporal anaphora. On her approach, the truth of a sentence is evaluated with respect to a reference time (say, just after I left home for school), which is determined by context or previous discourse. Ludlow claims his presentist approach accounts for temporal anaphora and complex tense just as well as the anaphora approach, but without referring to non-present events. The approach, however, assumes a certain view about what syntactic role tense plays and a certain view about what sort of semantic objects are the arguments of tenses, and how those objects are derived from syntactic structures.

8. Interpreted logical forms and the basics of the Ludlow theory

Ludlow proposes that tenses are semantic predicates which take untensed proposition-like objects as their arguments:

Val(x, PAST) iff x was true
Val(x, PRES) iff x is true
Val(x, FUT) iff x will be true

He proposes that the appropriate proposition-like objects are interpreted logical forms (ILFs), which he developed extensively in Larson & Ludlow (1993) and discussion of which he also attributes to Higginbotham (1986 & 1991), Segal (1989), and Larson & Segal (1995). According to Ludlow, ILFs are basically syntactic trees with the syntactic category labels of each node replaced by an ordered pair of that syntactic category label and its semantic value. Each node represents the entire sub-tree which it dominates; thus the syntactic category in the ordered pair is the category of that sub-tree, and the semantic value is the semantic value of the entire sub-tree⁹:

⁹Ludlow argues that the value of a predicate expressed by a verb phrase (“arrives,” “walks,” “leaps”) depends on its sentential context. “Predicates do not refer to their extentions; rather, their senses specify rules of classification which are applied to the referent of the subject expression” (p 46). Thus, in this context, the semantic value of “arrives” is not the set of all arriving things, but rather Jane herself.
For reasons detailed in Larson & Ludlow (1993) and also in chapter 3 of Ludlow (1999), tensed ILFs are most useful for dealing with problems arising in intensional contexts. But untensed ILFs play a crucial role in Ludlow’s presentist semantics: they serve as the arguments of tense predicates, as follows (where |S| = the ILF of S):

Val(x, PAST) iff x was true
Val(x, PRES) iff x is true
Val(x, FUT) iff x will be true

Val(True, [S TNS S1]) iff, for some x, Val(x, TNS) and x = |S1|

New syntax:
S → TNS S1
TNS → PAST, PRES, FUT

Example derivation:

“Fred was hungry.”

New syntax:
S → TNS S1
TNS → PAST, PRES, FUT

Example derivation:

1. “Fred was hungry” is true iff, for some x, Val(x, [TNS PAST] and x = |“Fred be hungry”|
2. . . . iff |“Fred be hungry”| was true

9. Complex tenses and temporal anaphora in Ludlow’s semantics

To account for the semantics of sentences traditionally taken to require temporal anaphora, like Partee’s example “I did not turn off the stove,” Ludlow adopts Partee’s (1984) general approach but significantly modifies her account of anaphora. Ludlow claims that tensed sentences that appear to refer to a specific non-present time actually contain implicit temporal adjunct clauses which function as E-type anaphors in the sense of Evans (1977): just as E-type pronominal anaphors don’t refer directly to the referents of the expressions the pronouns are coindexed with but rather “stand proxy for” Russellian definite descriptions, E-type temporal anaphors don’t refer directly to the events which constitute the contents of their clauses or the times at which the contents of their clauses hold. Instead, they are “general” descriptions\textsuperscript{10}. In simply

\textsuperscript{10}Ludlow emphasizes two distinctions in establishing the non-referentiality of temporal adjunct clauses (pp. 112-114):

- **Singular vs. general propositions.** Singular propositions are propositions about some particular object, e.g., “Bill is tall.” General propositions aren’t about anything in particular, but are rather general claims about the world, e.g., “No one lives forever.” Ludlow’s temporal adjunct clauses are supposed to be general propositions (or proposition-like objects).

- **Reference vs. denotation.** In cases of genuine reference, expressions refer directly to individuals: “Fred,” “Jane.” Denoting expressions instead uniquely determine their referents via description: “the the man who walked into the room,” “the king of France.” Denoting expressions may refer to a collection of properties that the some entity uniquely satisfies. Ludlow’s temporal adjunct clauses are supposed to be denoting and not referring expressions.
tensed sentences like “I did not turn off the stove,” then, according to Ludlow, there is an unpronounced “when-clause,” the contents of which are determined by context or previous discourse in much the same way as Partee’s (1984) reference times are determined by context or previous discourse, which serves as a non-referring E-type temporal anaphor:

I did not turn off the stove (when I left the house this morning).

Such implicit temporal adjunct clauses, claims Ludlow, have the same general structure as overt clauses, and moreover are tensed consistently with the overt clauses they are paired with (pp 118-119). Thus the structure of the above sentence would be the following:

```
S
  \-- S1
       \-- TNS PAST S2
            \-- I not turn off stove
       \-- when
       \-- S3
            \-- TNS PAST S4
                 \-- I leave house this morning
```

And Ludlow’s truth conditions for this sentence would be the following:

“I did not turn off the stove (when I left the house this morning)” is true iff [[I not turn off stove]] was true when [[I leave house this morning]] was true.

Crucially, when the temporal connective “when” that connects the explicit and implicit tensed clauses is translated into the metalanguage, it is treated as primitive and uninterpretable, with none of its usual meanings like “at the same time” or “simultaneous with” that could potentially involve commitment to past times or B-series-like relations.

Likewise in other cases of sentences apparently requiring temporal anaphora. Thus in the pair of sentences

Sheila had party last Friday. Sam got drunk.

the sentence “Sam got drunk” would be interpreted as having the following structure and truth conditions:

“Sam got drunk (when Sheila had a party)” is true iff [[Sam get drunk]] was true when [[Sheila have a party]] was true.

Ludlow also introduces similarly unanalyzable temporal connectives before and after to account for the meanings of the complex tenses:

- Pluperfect: PAST[S] before PAST[. . . ]
- Future perfect: FUT[S] before FUT[. . . ]
- Future in future: FUT[S] after FUT[. . . ]
- Future in past: PAST[S] after PAST[. . . ]

In a pair of sentences like

Jones arrived. Smith had already left.
The second sentence, which is in the past perfect tense, would be given something like the following truth conditions:

“Smith had already left (when Jones arrived)” is true iff \[[Smith leave]\] was true before \[[Jones arrive]\] was true.

Likewise a future perfect sentence like “I will have graduated” will receive truth conditions like the following, given that context or previous discourse has established the content of the temporal adjunct clause to be, for example, “FUT[[Jane come to school here in September]]”:

“I will have graduated (when Jane comes to school here in September)” is true iff \[[I graduate]\] will be true before \[[Jane come to school here in September]\] will be true.

Now that the crucial machinery has been introduced, here is an axiomatic summary of Ludlow’s theory, including the extra syntax required to account for the implicit temporal adjunct clauses:

**Syntax:**

\[
S \rightarrow TP1 \text{ when } TP2 \\
S \rightarrow TP1 \text{ before } TP2 \\
S \rightarrow TP1 \text{ after } TP2 \\
TP \rightarrow \text{TNS } S \\
\text{TNS } \rightarrow \text{PAST} \\
\text{TNS } \rightarrow \text{PRES} \\
\text{TNS } \rightarrow \text{FUT}^{11}
\]

**Semantics:**

Val(x, PAST) iff x was true
Val(x, PRES) iff x is true
Val(x, FUT) iff x will be true

Val(True, \[[TP \text{ TNS } S]\]) iff, for some x, Val(x, TNS) and x = \[[S]]

Val(True, \[S \text{ TP1 when TP2}\]) iff Val(True, TP1) when Val(True, TP2)
Val(True, \[S \text{ TP1 before TP2}\]) iff Val(True, TP1) before Val(True, TP2)
Val(True, \[S \text{ TP1 after TP2}\]) iff Val(True, TP1) after Val(True, TP2)

---

11It’s unclear how these rules are meant to interact with the sentence-or-ILF-internal rules. Something like the following appears to be necessary:

\[S \rightarrow \text{NP VP-tenseless}\]
Example derivation:

"Smith had left (when Jane arrived)."

1. “Smith had left (when Jane arrived)” is true iff Val(True, [TP1 [TNS PAST] [S1 Smith leave]]) before Val(True, [TP2 [TNS PAST] [S2 Jane arrive]])
2. . . . iff, for some x, Val(x, [TNS PAST]) and x = [S1 Smith leave] before, for some y, Val(y, [TNS PAST]) and y = [S2 Jane arrive]
3. . . . iff, for some x, Val(x, PAST) and x = [Smith leave] before, for some y, Val(y, PAST) and y = [Jane arrive]
4. . . . iff Val([Smith leave], PAST) before Val([Jane arrive], PAST)
5. . . . iff [[Smith leave]] was true before [[Jane arrive]] was true

10. Objections to the A-theory

Ludlow answers some objections about “limitlessness,” scope ambiguity and potentially incorrect truth conditions for sentences with more than one temporal modifier (e.g., “Smith left yesterday”) by positing a syntax in which all temporal modifiers occupy the same syntactic level. To see the objections, consider an A-theory semantics in which tenses are sentential operators:

\[
  S \\
  \downarrow \\
  \text{PAST} \quad \text{S} \\
  \downarrow \\
  \ldots
\]

On an account like this, the complex tenses are typically derived by nesting the operators:
Past perfect: PAST[PAST[S]]  
Future perfect: FUT[PAST[S]]

But if the syntax and semantics allows nesting of tense operators, then they should also allow arbitrarily complex tenses:

\[
PAST[PAST[PAST[S]]]  
PAST[FUT[PAST[PAST[S]]]]  
FUT[FUT[PAST[FUT[PAST[FUT[S]]]]]]
\]

But we rarely if ever see such tenses in natural languages (Comrie 1985), thus a theory like this “wildly overgenerates the set of possible tenses” (Ludlow, p. 103). Ludlow avoids overgeneration in his theory by building a semantics and syntax in which tense operators do not take scope over one another.\(^{12}\)

There is also the question of ambiguity in sentences with more than one temporal modifier like “Smith left yesterday”:

\[
PAST[YESTERDAY[Smith leave]]  
YESTERDAY[PAST[Smith leave]]
\]

A sentence with the first structure will be true iff at some time in the past it was true that yesterday Smith left (i.e., at some time in the past, Smith had left the day before that). A sentence with the second reading

\(^{12}\)While it is true that the tense operators PAST, PRES, and FUT cannot directly attach to one another, according to Ludlow’s proposed syntax, they can take scope over each other indirectly. The following three rules alone generate sentences of arbitrary length and arbitrarily complex tense structure:

\[
S \rightarrow TP1 \text{ before } TP2  
TP \rightarrow TNS S  
TNS \rightarrow PAST 
\]

For example:
will be true iff yesterday it was true that Smith left at some time in the past (i.e., if yesterday, Smith had already left at some time). But this sentence has only one meaning, and neither reading captures it—what we mean to say when we utter the sentence “Smith left yesterday” is that Smith left, and that when he left, it was yesterday. To resolve these problems, Ludlow posits a syntax (Appendix T5) in which all temporal modifiers (with the exception of aspectual modifiers) occupy the same syntactic level. Ludlow’s syntax gives “Smith left yesterday” the following structure:

Since the PAST tense modifier and the ADV modifier “yesterday” are on the same syntactic level, neither one can take scope over the other.

11. **Ludlow’s resolution of McTaggart’s paradox**

Ludlow claims his presentist semantics, in addition to making semantics consistent with presentism, also resolves McTaggart’s paradox.

Recall that McTaggart’s (1908) paradox starts with the observation that if A-properties are real, then they are mutually inconsistent, but every moment possesses all of them:

"Past, present, and future are incompatible determinations . . . But every event has them all. If M is past, it has been present and future. If it is future, it will be present and past. If it is present, it has been future and will be past." (ibid.)

Formulation of the contradiction as a logical conjunction of statements predicking A-properties of events or times, something not to be found in McTaggart (1908) but nevertheless something which seems to be widespread in works citing him, yields the following (replacing M with X):

\[ \text{Past}(X) \land \text{Present}(X) \land \text{Future}(X) \]

Ludlow notes (p 12) that each of the conjuncts can be reformulated as a natural language sentence:

\[
\begin{align*}
X \text{ is past} \\
X \text{ is present} \\
X \text{ is future}
\end{align*}
\]

If his semantic theory is right, then each of these sentences must have an implicit temporal adjunct clause:

\[
\begin{align*}
[X \text{ is past}] \text{ when } [\ldots] \\
[X \text{ is present}] \text{ when } [\ldots] \\
[X \text{ is future}] \text{ when } [\ldots]
\end{align*}
\]

Now, assuming that X is a sentence and that predicking pastness, presentness, or futureness of it using natural language is equivalent to giving it past, present, or future natural language tense (which Ludlow covertly does), his semantics will give the following truth conditions (we also need to assume that the temporal adjunct clauses have the same tense as the original clauses to which they’re adjoined; this is covered in the part of the exposition on pp. 118-119):
"X is past when [ . . . ]" is true iff X was true when [ . . . ] was true.
"X is present when [ . . . ]" is true iff X is true when [ . . . ] is true.
"X is future when [ . . . ]" is true iff X will be true when [ . . . ] will be true.

Then the truth conditions of the natural language formulation of the contradiction will be the following:

"X is past when [ . . . ] and X is present when [ . . . ] and X is future when [ . . . ]" is true iff
X was true when [ . . . ] was true and X is true when [ . . . ] is true and X will be true when [ . . . ] will be true.

Ludlow argues that the three conjoined metalanguage statements above are "not incompatible, since the when-clauses will have different contents. In short, once we introduce E-type anaphora, the McTaggart argument will fail to get off the ground" (p 12).

12. Conclusion

Whether or not Ludlow’s semantics actually resolves McTaggart’s paradox, it certainly represents an innovative and unusually comprehensive approach to the metaphysics of time and the semantics of temporal expressions. Jokić and Smith (2003) call this work “the first major step toward solving the problem of the lack of a sufficient interconnection between workers in the philosophy of language and the philosophy of time,” noting that it combines “a comprehensive philosophy of language (including even substantial results in linguistics...) with details of the most recent debates among defenders of the tensed and tenseless theories of time...” (p 6).

But few first steps are without at least a bit of instability. Ludlow’s argument faces challenges on both linguistic and semantic grounds; in my view, here are some of the most pressing issues:

• The premises of Ludlow’s argument for presentism are phenomenological, not semantic. Even if A-theory semantics is necessary to deal with temporal indexicality, it doesn’t follow from semantic (or metaphysical) premises alone that presentism is a better alternative than eternalism or growing universe theory.

• Ludlow claims that his argument will be unaffected if I-language happens not the be the language of thought. However, if it is not the case both that (a) thought is fundamentally linguistic in nature and that (b) I-language is the language of thought, then arguments from semantics to metaphysics (like arguments from (1) and (2) above to A-theory metaphysics) and arguments from metaphysics to semantics may remain unaffected, but Ludlow’s “synthetic” approach (Jokić and Smith, 2003, p. 7) does not: since he argues both that certain undesirable consequences of his semantics be tolerated in the name of saving his metaphysics, and that certain troubles his metaphysics faces be tolerated in virtue of the appeal of his semantics, it is in fact quite important to his argument that semantics and metaphysics be granted equal status. But if either of (a) and (b) is false, then it won’t be semantics that is granted equal status with metaphysics by the Kantian approach, but rather whatever theory actually addresses the structure of human thought, e.g., psychology, cognitive science, etc.

• In cases of E-type pronominal anaphora, the entities which satisfy the definite descriptions (“the man who just walked in,” “the king of France”) must actually exist for the description to be meaningful. On Ludlow’s theory, there are no past or future events to satisfy his so-called “E-type” temporal descriptions; thus, it seems unlikely that they can be meaningful in the same way as the E-type descriptions on which they are based.

However his argument holds up in the end, Ludlow’s work may certainly be regarded, as Jokić and Smith suggest, as an ideal case of productive synthesis of heretofore typically isolated lines of inquiry in philosophy of language, philosophy of time and linguistics. The issues raised here lie close to the foundations of these disciplines, and, as I believe Ludlow’s work demonstrates, investigating them in parallel can reveal unanswered questions and unresolved conflicts of great significance to each of them.
References


